Structure–Property Relationships in Polymers

R. B. Seymour and C. E. Carraher

Plenum Publishing Corp. (New York), 1984, 246 pp, US$22.50
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Ask a cross-section of polymer scientists what is their general area of interest and a substantial number will reply: structure–property relationships. It is surprising then that while there are many monographs on aspects of this subject, this book by Seymour and Carraher is one of the few that has attempted to bring together the various threads into one compact volume.

The book can be divided roughly into two parts. In the first two chapters there is a brief introduction to the chemical and physical structure of polymers. These are followed by eight chapters devoted to a fairly brief description of the testing methods and the properties of interest such as optical, mechanical, electrical, thermal, solubility, diffusion and chemical resistance. In the remaining five chapters there is a change of emphasis and these deal more specifically with the properties of selected groups of polymers. This includes coverage of the polyolefins and other vinyl polymers, materials with heteroatomic chains, high performance materials and speciality polymers.

The authors have attempted to deal with this extensive subject material in only 210 pages and so, as one might expect, the treatment is terse and only the fundamentals are presented. Nevertheless, they have succeeded in packing a remarkable amount of information into this space and fact tends to tumble rapidly after fact. The price paid for this is a lack of coherence in presentation and a general feeling that a more satisfying book would have been achieved by providing a greater in-depth treatment of some of the earlier chapters. This means that the level of presentation is suitable for undergraduates who are undertaking an intensive course on polymer science, but for UK students it is much more likely that postgraduates will be the group to benefit most from this text.

The main strength of the book lies in the fact that the material properties of polymers that are often dealt with in isolation are now placed in juxtaposition, thereby stressing their inter-relation, and the authors are to be congratulated for attempting this exercise. The visual presentation is good and the book is reasonably free from typographical errors. Of these the incorrect formulae for 3,4 polyisoprene and PEEK should be eliminated as soon as possible, but the others are relatively minor.

The book should not be regarded as a comprehensive reference volume but is worth buying because it provides a useful overview of the physical properties of polymers and could form the basis of a taught course on this subject.

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Plastics for Electronics

Martin T. Goosey (Ed.)

Elsevier Applied Science Publishers (London and New York), 380 pages, £45
ISBN 0-853-34338-1

As is quite common for books with a number of contributors the chapters are very variable. This difference is not so much one of quality but rather demands made on the reader. Thus, whilst one chapter may be of value and at the right level to one reader, to another it may be pitched too low or too high. Perhaps this is a ploy on the part of the publishers to increase the market for the book!

'Plastics for Electronics' makes a rather slow start. A very elementary Chapter 1 is followed by a chapter that covers many aspects raised in the first but more scientifically and at greater depth. Chapters 3 and 4 are reviews of silicone and epoxide resins, respectively, for use in electronic applications. Much of the content of Chapter 4 has been available in monographs on epoxide resins published over the past 28 years.

Chapter 5, dealing with encapsulation using transfer moulding, contains much practical advice. I do, however, prefer drawings to photographs as an aid to understanding the text. Graphical presentation could have been better and in a rare example there was a scale of values along the base line only.

In Chapter 6 the text 'moves up a gear'. This chapter concerns device reliability and gives much candid information on limitations of plastics encapsulation. The chemistry of polymers applied to semiconductors by lithographic methods forms the subject of Chapter 7. Techniques discussed, in addition to the well established photolithography include electron lithography, X-ray, ion-beam and deep-u.v. lithography.

Chapter 8, on plastics for telecommunications, could have been a very boring review. The author, however, not only shows a knowledge of some of the latest materials but also gives a very useful review of the problems encountered with available materials. Such a critical appraisal will be welcome to many.

After a chapter on plastics for printed wiring substrates the final chapter deals with a miscellany of topics, many of recent origin. These include some fascinating insights into current challenges. The reliability of data storage in microchips may be affected by electrons generated by the reaction of alpha particles with the atomic structure of the chip. In turn the alpha particles occur by reactive decay of actinide elements such as thorium and uranium. Traces of these actinides can occur in fillers and it is now recognized that levels as low as one part per billion can lead to reliability errors. Another useful piece of information is concerned with optical data storage media. The potential ability of photographic emulsions to store data is such that the contents of the Concise Oxford Dictionary could be stored on just a few centimetres of 35 mm film.

A statement of fact, not criticism, is that this monograph has little to say about recent developments in electroactive polymers. Polymers showing piezoelectric, pyroelectric, photoconductive and semiconductor properties are of much current interest but were presumably deemed not to be within the scope of coverage required.

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